

The University of Chicago

SPECIAL DISABILITY IN READING
AND ARITHMETIC

A PART OF A DISSERTATION SUBMITTED
TO THE FACULTY OF THE DIVISION OF
THE SOCIAL SCIENCES IN CANDIDACY FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY

DEPARTMENT OF EDUCATION

1932

By
ROBERT COOK SCARF

Private Edition, Distributed by
THE UNIVERSITY OF CHICAGO LIBRARIES
CHICAGO, ILLINOIS

Reprinted from
BULLETIN OF THE SCHOOL OF EDUCATION, Indiana University
Vol. X, No. 1, December 1933

The University of Chicago

SPECIAL DISABILITY IN READING AND ARITHMETIC

A PART OF A DISSERTATION SUBMITTED
TO THE FACULTY OF THE DIVISION OF
THE SOCIAL SCIENCES IN CANDIDACY FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY

DEPARTMENT OF EDUCATION

1932



By
ROBERT COOK SCARF

Private Edition, Distributed by
THE UNIVERSITY OF CHICAGO LIBRARIES
CHICAGO, ILLINOIS

Reprinted from
BULLETIN OF THE SCHOOL OF EDUCATION, Indiana University
Vol. X, No. 1, December 1933

Special Disability in Reading and Arithmetic

R. C. SCARF, Assistant Professor of Education, Ball State
Teachers College

THE problem of special disability, or unevenness in abilities, was studied by selecting for comparison two abilities which are quite unlike, namely, reading and arithmetic. The term "unevenness in abilities" is used in this paper to indicate the situation in which a person is better in one of these abilities than in the other. The study was carried on with freshmen at Ball State Teachers College, and supplemented with case studies of school children.

Unevenness of Abilities in Reading and Arithmetic Among the Freshmen of a State Teachers College

The subjects for the study of teachers college freshmen consisted of all freshmen who entered the Ball State Teachers College at Muncie, Indiana, from October, 1927, to May, 1931. There were 1,717 freshmen included. The records of negroes and foreign-born students were excluded. Results were used from two kinds of tests, a test of reading and a test of problem-solving in arithmetic. Different tests were used in different years, as follows:

1927-28. Ohio State University Psychological Test—Part 1, Arithmetic Problems; Part 5, Reading.

1928-29. Psychological Examination of the American Council on Education (1928 edition)—Test 4, Arithmetic; Thorndike-McCall Reading Scale, Form 8.

1929-30. Same as 1928-29, except that Form 7 of the Thorndike-McCall Reading Scale was used in place of Form 8.

1930-31. Psychological Examination of the American Council on Education (1930 edition)—Test 4 Arithmetic; Nelson-Denny Reading Test, Form A.

The data for each year were treated separately. Each freshman's scores were turned into standard scores, and the reading score was subtracted from the arithmetic score. The sign of the difference was disregarded. This difference was called d or d-score, and is a measure of unevenness, i.e., of the extent to which one ability is superior to the other.

It was found that freshmen who came from broken homes were more uneven in their abilities than those who came from normal homes. The term "broken home" was used to denote families where the parents were separated, where either or both parents were dead, or where the mother was working outside the home.

An interview was held with each of the college freshmen, still in college, who came from a broken home. Questionnaires were sent to

those who had left college. In five cases information was secured from a sibling. Interviews were held with 130 women and 41 men. Questionnaires were sent to 84 women and 50 men, and replies were received from 71 women and 30 men.

In the interviews, questions were asked about the student's dislike for any particular school subject, and about difficulties in learning which had been met at any time. The student was also questioned about his family, the time when it was broken up, and the relation of the student to the missing parent. The questionnaires also contained questions about the student's dislike for, or difficulty with, school work, and about the breaking up of the home.

Tables I, II, III, and IV show the d-scores (measures of unevenness) of the college freshmen, separated according to sex and according to type of home. The d-scores of certain students are excluded from these tables, viz., cases where the home was broken up before the child began school, or after he had finished high school. In Table V the means of the groups from broken homes are compared with the means of the groups from normal homes, and in Table VI the standard deviations of the various groups are brought together for a similar comparison.

TABLE I. D-SCORES OF WOMEN FROM BROKEN HOMES

D-Score	Year of College Entrance			
	1927-28	1928-29	1929-30	1930-31
3.3—3.5.....	..	..	..	1
3.0—3.2.....	1	1	..	0
2.7—2.9.....	0	0	..	0
2.4—2.6.....	2	4	1	1
2.1—2.3.....	2	0	2	2
1.8—2.0.....	4	4	4	3
1.5—1.7.....	9	5	7	1
1.2—1.4.....	3	11	4	7
.9—1.1.....	6	7	4	10
.6—.8.....	5	7	3	0
.3—.5.....	9	6	0	6
.0—.2.....	4	7	5	2
N.....	45	52	31	33
Mean.....	1.15 ± .077	1.10 ± .066	1.24 ± .079	1.21 ± .083
SD.....	.766 ± .054	.705 ± .047	.655 ± .056	.706 ± .059

TABLE II. D-SCORES OF MEN FROM BROKEN HOMES

D-Score	Year of College Entrance			
	1927-28	1928-29	1929-30	1930-31
2.4-2.6.....	1	2	..	..
2.1-2.3.....	0	0	..	..
1.8-2.0.....	0	1	..	1
1.5-1.7.....	3	2	1	4
1.2-1.4.....	1	1	0	0
.9-1.1.....	1	3	2	2
.6-.8.....	4	1	4	1
.3-.5.....	2	4	2	1
.0-.2.....	2	4	1	4
N.....	14	18	10	13
Mean.....	.91±.108	.97±.118	.73±.094	.90±.123
SD.....	.598±.076	.740±.083	.443±.067	.656±.089

TABLE III. D-SCORES OF WOMEN FROM NORMAL HOMES

D-Score	Year of College Entrance			
	1927-28	1928-29	1929-30	1930-31
3.6-3.8.....	1	..	..	..
3.3-3.5.....	0	..	1	1
3.0-3.2.....	1	..	1	1
2.7-2.9.....	2	1	0	0
2.4-2.6.....	7	4	2	5
2.1-2.3.....	6	3	3	7
1.8-2.0.....	10	8	12	8
1.5-1.7.....	14	18	12	10
1.2-1.4.....	26	28	15	21
.9-1.1.....	39	30	35	24
.6-.8.....	59	45	39	46
.3-.5.....	60	47	43	45
.0-.2.....	57	44	43	59
N.....	282	228	206	227
Mean.....	.81±.026	.81±.026	.84±.029	.81±.030
SD.....	.65±.018	.59±.018	.62±.021	.66±.021

TABLE IV. D-SCORES OF MEN FROM NORMAL HOMES

D-Score	Year of College Entrance			
	1927-28	1928-29	1929-30	1930-31
3.0-3.2.....	..	2	..	2
2.7-2.9.....	3	0	1	5
2.4-2.6.....	1	4	0	1
2.1-2.3.....	5	6	5	8
1.8-2.0.....	6	8	4	8
1.5-1.7.....	10	10	8	6
1.2-1.4.....	13	9	8	5
.9-1.1.....	20	19	21	11
.6-.8.....	18	13	16	15
.3-.5.....	38	24	24	23
.0-.2.....	20	21	16	14
N.....	134	116	103	98
Mean.....	.87±.038	.97±.061	.90±.044	1.11±.057
SD.....	.66±.027	.74±.043	.61±.031	.84±.040

TABLE V. COMPARISON OF MEAN D-SCORES OF SUBJECTS FROM NORMAL HOMES AND SUBJECTS FROM BROKEN HOMES

Group	Means, Broken Homes	Means, Normal Homes	Difference of Means	Ratio of Difference to its PE
Women—				
1927-28.....	1.15±.077	.81±.026	.36±.080	4.5
1928-29.....	1.10±.066	.81±.026	.29±.071	4.1
1929-30.....	1.24±.079	.84±.029	.40±.084	4.8
1930-31.....	1.21±.083	.81±.030	.40±.088	4.5
Men—				
1927-28.....	.91±.108	.87±.038	.04±.114	0.4
1928-29.....	.97±.118	.97±.061	.00±.133	0.0
1929-30.....	.73±.094	.90±.044	.17±.104	1.6
1930-31.....	.90±.123	1.11±.024	.21±.125	1.7

From Table V it appears that women who come from broken homes show more unevenness of abilities than women from normal homes. The difference is statistically reliable for each group. The difference is shown consistently each year. The textbooks on statistics set up the criterion that the difference between two means must be at least four times as large as its own probable error in order to be regarded as reliable. For the women, this criterion is met for each of the four years. It is safe to conclude that there is a genuine difference between women from broken homes and women from normal homes.

Another way of comparing the women from normal homes with the women from broken homes is to compare the distributions with respect to dispersion. For this comparison, the standard deviations of the d-scores for the various groups have been brought together in Table VI. When the women from normal homes are compared with the women from broken homes with respect to the standard deviations of the d-scores, it is seen that the differences are small. The largest one is .12 with a probable error of .05. Since this difference is only 2.4 times as large as its probable error, it is not reliable. The other differences are all small in relation to their own probable errors. These differences are therefore to be regarded as probably due to sampling errors. The conclusion is that the distributions are not reliably different with respect to dispersion. This means that the difference between the means, which was discussed in the preceding paragraph, is not due to a few extremely high d-scores among the women from broken homes. Instead, the trait "unevenness" should be thought of as occurring among women from broken homes in greater degree than among women from normal homes.

TABLE VI. COMPARISON OF STANDARD DEVIATIONS OF D-SCORES OF SUBJECTS FROM NORMAL HOMES AND SUBJECTS FROM BROKEN HOMES

Group	Standard Deviations, Broken Homes	Standard Deviations, Normal Homes	Difference	Ratio of Difference to its PE
Women—				
1927-28.....	.76 ± .054	.65 ± .018	.11 ± .056	2.0
1928-29.....	.71 ± .047	.59 ± .018	.12 ± .050	2.4
1929-30.....	.66 ± .056	.62 ± .021	.04 ± .060	0.7
1930-31.....	.71 ± .059	.66 ± .021	.05 ± .063	0.8
Men—				
1927-28.....	.78 ± .099	.66 ± .027	.12 ± .104	1.2
1928-29.....	.80 ± .093	.74 ± .043	.06 ± .101	0.6
1929-30.....	.44 ± .067	.61 ± .031	.17 ± .074	2.3
1930-31.....	.66 ± .089	.84 ± .040	.18 ± .098	1.8

When the men from broken homes are compared with the men from normal homes (Table V and Table VI), it is seen that the men from normal homes show more unevenness than the men from broken homes.

However, the differences are not statistically reliable. The number of cases is too small to permit any conclusions.

There were 30 women and 11 men whose homes were broken up before they began to go to school, and who did not experience any further marked change in the family situation during their school careers. These cases were excluded from Tables I and II. The d-scores of these cases were considerably lower, on the whole, than the d-scores of the students whose homes were broken up while they were attending school. For the 30 women, the d-scores ranged from .1 to 2.1, with a mean of .64. This mean is considerably lower than the means for the women from normal homes, which are given in Table III, and which range from .81 to .84. Of the 30 women whose homes were broken up before they entered the first grade, only seven have d-scores above .8, that is, above the mean for women from normal homes, and only two have d-scores which are above 1.0.

The men whose homes were broken up before they entered Grade I number 11, with d-scores ranging from .1 to .8. All have d-scores below the mean for men from normal homes.

There were 9 freshmen whose homes were broken up after they had finished high school—7 women and 2 men. The d-scores for the women range from 0 to .9, with a mean of .5. The d-scores for the 2 men in this group are 1.3 and .7. These d-scores are all small.

It is evident that college freshmen who come from broken homes, but whose homes were broken up before they started to go to school or after they finished high school, do not differ from college freshmen who come from normal homes with respect to the trait "unevenness." The conclusion seems to be that unusual unevenness is not associated with the fact of living in a broken home, but rather with the experience of having the home broken up while learning is going on. This fact also makes it seem improbable that excessive unevenness, as it has been measured in this study, is associated with any hereditary factor.

It was found, in interviewing college students, that many students were fully aware of the fact that one ability was inferior to the other, and that many of them could set a definite time for the beginning of the inferiority. The descriptions given by the students took various forms. Some said that they hated arithmetic, or had a very strong dislike for it. Others professed to have no dislike for arithmetic, but had found it hard to learn compared with other studies. With respect to reading, similar accounts were given. It was found that many students whose reading ability was inferior gave accounts of dislike for, or difficulty with, geography, literature, history, or science. As these studies involve reading, such accounts were taken to mean difficulty with reading.

Similar reports were found in the questionnaires. In many cases the student's account showed that his dislike for, or difficulty with, one of the school subjects began soon after the home was broken up. A count was made of such cases and the result is shown in Table VII. In making up this table, certain cases were excluded from consideration. The cases excluded were those where the change in the family occurred before the child had begun school, or after the child had finished the twelfth grade.

The point at issue is: Did a significant proportion of the college students from broken homes report a special difficulty or a special dislike for reading or for arithmetic which began soon after a major change in the family situation? A major change in the family situation means the loss of one or both parents by death or by separation, the mother beginning to work outside the home, the entrance of a step-parent into the home,

TABLE VII. NUMBER OF CASES IN WHICH A SPECIAL DIFFICULTY WITH SOME SCHOOL STUDY APPEARED SOON AFTER A MAJOR CHANGE IN THE FAMILY

Group	Number of Students Who Experienced a Major Change in the Family While in Grades I-XII	Number Who Reported a Special Difficulty in School Work at the Time of the Change in the Family	Per Cent so Reporting
Women—			
1927-28.....	46	19	41
1928-29.....	48	16	33
1929-30.....	30	13	43
1930-31.....	32	13	41
Men—			
1927-28.....	15	6	40
1928-29.....	14	7	50
1929-30.....	8	3	38
1930-31.....	13	4	31
All women.....	156	61	39
All men.....	50	20	40
Total.....	206	81	39

or the separation of the child from a foster-parent. Difficulty with reading is interpreted to include difficulty with history or geography, as these studies are dependent largely upon the use of books, and in many schools children are encouraged to read widely in connection with these studies. "Soon after" means within a year, that is, during the same semester or the next following semester.

One characteristic of Table VII is the uniformity of the percentages in the last column. The range is from 31 to 50, while 5 of the 8 percentages fall between 38 and 43. This uniformity is surprising, in view of the small numbers in some of the groups. With respect to the facts of Table VII, men do not differ from women.

This table, however, does not tell the whole story. Many of the subjects have passed thru more than one major change in the family situation. The total number of such changes, for the 206 cases in Table VII, is 276. There were, therefore, 276 chances for a student to report that he had met some special difficulty in learning soon after

a change in the family. Eighty-one such reports were given, or 29.3 per cent of 276.

Since there are twelve school years under consideration, a report of the kind counted in Table VII would by chance occur in one-twelfth of the cases, or 8.3 per cent. This theoretical chance percentage is to be compared with the observed percentage of 29.3 per cent. The probable errors of these percentages, when N is 276, were computed. For 8.3 per cent, the probable error is .011; for 29.3 per cent, the probable error is .018. The difference between these percentages is .210, with a probable error of .021. This difference is ten times as great as its own probable error. The conclusion is that the observed percentage is certainly reliable and cannot be due to fluctuations of sampling. It is safe to conclude that there is a genuine tendency for college students who come from broken homes to report that they met some difficulty in either reading or arithmetic soon after a major change in the family situation.

The percentages in Table VII seem high, when it is considered that the reports of the students concerning their difficulties in school must have been affected by many accidents of memory. Furthermore, it must be remembered that only two school subjects, reading and arithmetic, were considered, and that no information was given about disabilities which may have occurred in other school subjects. The consistency of the percentages from year to year also lends weight to any conclusion which may be drawn from Table VII. The conclusion seems justified that in a good many cases a child's dislike for reading or arithmetic, or a special difficulty with one of these subjects, begins shortly after the child's home has been broken up. This conclusion is true for men as well as for women.

In this section of the paper facts have been presented concerning the trait "unevenness" among the freshmen of a state teachers college. Unevenness was measured by comparing the score on an arithmetic test with the score on a reading test. The conclusions are:

1. A concomitant of unevenness in abilities is the experience of having the home broken up. This is true (*a*) for women but probably not for men, and (*b*) only for women whose homes are broken up while they are attending the elementary school or the high school.

2. Many college students who come from broken homes set a definite date for the beginning of their difficulties with some particular school subject. This beginning often follows closely after the date of the breaking up of the home. This is true for both men and women.

Case Studies of Children from Broken Homes

Case studies were made of 19 children who were living in broken homes. These children were found by visiting ten schools in Muncie, Indiana. Children were selected for study whose homes had been broken up within the last two years, whose school records showed results of standard achievement tests covering a period before and after the breaking up of the home, who did not show any unusual physical defect, and

who had attended the Muncie schools for at least three years before the home was broken up.

There were 7 boys and 12 girls among the 19 cases selected for study. The range of ages at the time of the breaking up of the home was from 9 to 14. In economic and social status there is a wide range, the father's occupation ranging from professional work to unskilled labor. There is also a wide range of intellectual capacity, as shown by intelligence tests, with I.Q.'s ranging from 80 to 140. The group is not a selected one in any sense, except that all are living in broken homes. In other respects they constitute a fair sample of the general population.

A variety of broken homes is found among these 19 cases representing 17 homes, as there are two pairs of siblings. There are 9 children living in homes where the father is separated from the family, 4 in homes where the father is dead, 4 in homes where the mother is dead, and 2 in homes where the mother works away from home during the day.

Each child was interviewed two or three times. The subjects were encouraged to talk freely about difficulties that had been met in school work, about likes or dislikes for any particular studies or teachers, and about conditions at home which seemed to have a bearing on school work. The children were usually frank and coöperative, and talked without reserve. A set procedure was not followed, and a fixed list of questions was not used, as it seemed better to encourage the child to talk freely, and to follow up, by appropriate questions, any suggestions given by the child.

Three cases will be reported in detail, sixteen others will be summarized briefly.

Case 1 is Charles, whose family is broken up by the absence of the father. The father works in a nearby town, and is home only for a few hours on every other Sunday. He began to work away from home in August, 1930, when Charles was 12 years and 6 months old.

Charles has attended the same school all his life, and has been promoted regularly. His I.Q. is 109 on the Stanford-Binet test. Two group tests of intelligence given at different times have given I.Q.'s of 96 and 108 respectively. The school record shows nothing unusual.

School records give the scores on standard tests for the school years 1928-29, 1930-31, and 1931-32. The record for the year 1929-30 is lost. In 1928-29 the tests used were the Woody-McCall Mixed Fundamentals (computing) and the Thorndike-McCall Reading Scale. In 1930-31-32, the New Stanford Achievement Test was used; the scores for Part 1, paragraph meaning, and Part 10, arithmetic computation, are reported here. By comparison with the author's norms, the scores were transmuted into grade standings. The results of these tests are shown in Table VIII.

TABLE VIII. SCORES ON STANDARD ACHIEVEMENT TESTS, CASE 1

Date	Grade Standing		Difference
	Computing	Reading	
Normal home—			
September, 1928.....	3.9	4.5	-.6
January, 1929.....	5.5	5.2	+.3
May, 1929.....	6.4	6.3	+.1
Mean.....	...	...	-.1
Broken home—			
September, 1930.....	5.9	7.5	-1.6
January, 1931.....	7.2	9.5	-2.3
May, 1931.....	7.1	10.0	-2.9
September, 1931.....	6.0	9.7	-3.7
January, 1932.....	6.0	10.1	-4.1
Mean.....	...		-2.9

In the column showing differences, the reading score was subtracted from the arithmetic score. Hence a plus sign means that arithmetic is the better ability, while a minus sign means that reading is better. In averaging these differences, or measures of unevenness, the signs were considered.

These tests showed that in the year 1928-29 Charles made scores which were fairly good for his grade. He was then in Grade 5. One ability was just about as good as another, and the differences shown in the last column of Table VIII are small. Charles was living in a normal home at that time.

After August, 1930, a different situation existed. From this time on Charles made good scores in reading and poor scores in computing. It was during this time that his father was away from home. Charles made rapid improvement in reading, and made scores well above the norms for his grade, while his computing ability showed no consistent improvement for a year a half.

Circumstances prevented an inquiry into Charles's family relationships; nothing was found to explain why Charles's learning should be interrupted while the father was absent.

Case Number 2 is Mary, who is living with her mother. The father left the family on September 9, 1929, when Mary was 10 years and 2 months old. This girl has been tested with two forms of the National Intelligence Test, which yielded I.Q.'s of 96 and 110 respectively. The school record shows nothing unusual, and confirms the I.Q. of about average. Mary was in Grade 6 when this study was made, and had been in the same school for four years. Records show scores on the standard tests for each of these four years. The tests used in 1928-29-30 were the Woody-McCall Mixed Fundamentals in computing and the Thorndike-McCall Reading Scale in reading. In 1930-31-32 the test used was the New Stanford Achievement Test. The record of standard tests covers one year when Mary was living in a normal home, and three years when she

was living in a broken home. The scores on standard tests, transmuted into grade standings, are shown in Table IX.

It is evident that Mary was fairly even in her abilities while living in a normal home. After the home was broken up, there was a change. Considerable unevenness appeared, because of a loss in reading ability during the year immediately after the separation of Mary's parents. By January, 1931, the unevenness was marked and for a year and a half thereafter it continued to be so.

When Mary was interviewed, she said that her favorite study was mathematics, and that she disliked English and geography. English, she thought, was not difficult, but she disliked it nevertheless. Geography seemed both difficult and uninteresting. These are the studies in which most reading is required in her school. Her dislikes are related to her mediocre ability in reading.

When asked to tell about the parent's interests and leisure time pursuits, Mary stated that her mother very seldom engaged in reading, but that her father sometimes did. Her father had no use for arithmetic in his vocation and had never helped Mary with it. Mary's ideas about arithmetic were associated with her mother. She thought that the mother made considerable use of arithmetic in buying for the household, estimating expenses, and keeping accounts. However, the mother never helped Mary with her school work.

TABLE IX. SCORES ON STANDARD TESTS, CASE 2

Date	Grade Standing		Difference
	Computing	Reading	
Normal home—			
September, 1928.....	3.3	3.9	-.6
May, 1929.....	5.0	4.7	+.3
Mean.....		...	-.2
Broken home—			
November, 1929.....	5.7	4.1	+1.6
March, 1930.....	7.2	5.7	+1.5
January, 1931.....	8.1	6.1	+2.0
May, 1931.....	10.7	7.9	+2.8
September, 1931.....	10.2	8.2	+2.0
January, 1932.....	10.9	9.8	+1.1
May, 1932.....	11.0	8.4	+2.6
Mean.....		...	+1.9

To this child, the father seemed to be the parent who was interested in reading, while the mother seemed to be interested in arithmetic. This is in harmony with the fact that after the father had left the household, the child made slow progress in reading.

The two cases which have been described are typical. Ten more case studies were made with similar findings and the essential facts from these case studies are shown in Table X, Cases 3 to 12.

Three cases differed somewhat from the two which have been described. In each of these cases, the child showed considerable unevenness before the home was broken up, and still greater unevenness afterward. However, the direction of unevenness was reversed, and the ability which was superior before the disruption of the family became the inferior ability afterward. The data for these cases appear in Table X, Cases 13 to 15.

TABLE X. CHANGES IN UNEVENNESS, CHILDREN IN BROKEN HOMES*

Case Number	Normal Home		Broken Home	
	Number of Tests	Mean Unevenness	Number of Tests	Mean Unevenness
1.....	3	-.1	5	-2.9
2.....	2	-.2	7	+1.9
3.....	4	+.6	2	+1.4
4.....	3	-.1	2	+.6
5.....	1	+.1	3	+.7
6.....	2	-.1	5	-.8
7.....	1	+.1	3	-1.4
8.....	1	0	4	-2.6
9.....	2	-.4	3	-2.1
10.....	3	-.4	2	-1.2
11.....	4	-.6	3	-2.2
12.....	2	-1.6	5	-4.2
13.....	2	-3.7	4	+2.1
14.....	2	-1.2	7	+1.3
15.....	3	-1.8	3	+.9

* In this table, unevenness is measured by the difference between a score on an arithmetic test and a score on a reading test. A positive measure means that arithmetic is the better, while a negative measure means that reading is the better. The unit used is the difference between the norms for two successive grades.

Four children were found who were temporarily separated from one parent. In each of these cases, a period of unevenness in abilities corresponded to the period of separation from the parent. After the child was again associated with the parent, the unevenness disappeared. One of these cases (Case 16) will be described in detail. The others will be reported more briefly.

Case 16 is a girl, Lucille, who was studied in May, 1932. She was 11 years and one month old at that time, and was enrolled in Grade 6.

Her mother worked in a factory for a time, so that it is possible to study this girl's performance at three different periods. In the first period the family situation was normal, in the second period the mother was working outside of the home, and in the third period the mother had quit work and the home was again normal. The mother started working in a factory in August, 1930, and worked steadily until December, 1931.

Lucille's intelligence has been measured by the National Intelligence Scale, Scale A, Form 1. This yielded an I.Q. of 107. This I.Q. is confirmed by the school record.

Scores on achievement tests are shown in Table XI. This table shows that Lucille was very even in her abilities during the period when her mother was not working. Good progress was made in both computing and reading, and both abilities stood at the same level. Soon after her mother started working, marked unevenness appeared, persisted until the mother stopped working, and disappeared when normal home conditions were restored. The changes from evenness to unevenness and back to evenness again are abrupt.

TABLE XI. SCORES ON STANDARD TESTS, CASE 16

Date	Grade Standing		Difference
	Computing	Reading	
Normal home—			
May, 1929.....	3.6	3.8	— .2
November, 1929.....	4.1	4.2	— .1
March, 1930.....	4.9	4.8	+ .1
September, 1930.....	5.1	5.2	— .1
Mean.....	...	...	— .1
Broken home—			
January, 1931.....	6.1	4.3	+1.8
May, 1931.....	6.3	4.6	+1.7
September, 1931.....	6.6	5.6	+1.0
Mean.....	...	...	+1.5
Normal home—			
January, 1932.....	6.4	6.3	+ .1

When questioned with respect to her likes and dislikes, Lucille said that history was the only study for which she felt an actual dislike. She thought that this dislike had begun while she was in Grade 4A. This is the grade in which she began to make low scores on reading tests. She reported that she habitually turned to her mother for help in reading, and to her father for help in arithmetic. This may explain why her reading ability declined while her mother was working.

Three other cases were found which were similar to Case 16. In each case the child displayed considerable unevenness while separated from a parent, but this unevenness disappeared and the child became even in his abilities when he was again associated with both parents.

Case 17 was a girl who, while living with her father, was fairly even in abilities, with unevenness scores of $-.1$ and $+1.5$ at two testing periods. Her father left the household for a year and a half. At the beginning of the period of separation the child's computing ability

reached the norm for Grade 4.8, while reading ability reached the norm for Grade 4.4. A year and a half later, computing ability still stood at 4.8, while reading ability had increased to 6.4, that is, considerable unevenness had appeared. Her father then rejoined the family, and soon after the two abilities stood at 6.0 and 6.3 respectively, showing very little unevenness. This girl thought of her father as the arithmetician of the family, but received no direct help from him.

Cases 18 and 19 are two brothers. Their abilities were very even while they were living in a normal home. The father deserted the family, and unevenness appeared in the records of both boys, with arithmetic as the inferior ability. In Case 18, the mean unevenness, measured by three tests at different times, was $+1$, while he was living in a normal home. Three months after the separation from the father, a computing test showed ability typical of Grade 6.4, while reading ability reached the norm for Grade 7.8, a considerable degree of unevenness. Soon after these tests were given, the boy began to see his father daily, going to the father's shop to work on afternoons and Saturdays. While he was thus closely associated with the father, tests showed computing ability of 7.1, and reading ability of 7.0, or unevenness which was nearly zero.

Case 19 shows a similar record. While the home was normal this boy was tested twice, with unevenness averaging -2 , in terms of grade norms. After the disruption of the home, reading ability reached the norm for Grade 7.5, while computing ability barely reached the norm for Grade 6, and the unevenness amounted to 1.5 grades. This boy, like his brother, then formed the habit of going to his father's shop daily. Tested twice after this habit was formed, it was found that the unevenness was $+1$ at one testing, and -5 at another.

The two brothers stated that the father never read anything, but that he used arithmetic a great deal in his shop (an auto repair shop). They thought that the mother was quite lacking in arithmetical ability, but that she read a great deal. The boys' ideas about the father are in harmony with the fact that their computing ability declined when they were kept away from him.

Summary and Conclusions

The study of nineteen children who lived in broken homes shows clearly that unevenness appears soon after the disruption of the family and increases gradually. When the children gave accounts of their experiences at home, it was found that a differential association between parents and school subjects had been set up, such that one parent seemed to the child to be the exemplar and stimulator of arithmetic, while the other served a similar rôle with respect to reading. Sixteen children were questioned on the point, and ten gave evidence of such a differential association. Each of the ten made little or no progress, after the disruption of the home, in the ability which was associated with the missing parent.

The following conclusions seem justified by the study of college freshmen and of school children:

1. When unevenness of abilities is measured by comparing arithmetic ability with reading ability, those who live in broken homes are more uneven than those who live in normal homes.
2. Unevenness in abilities begins soon after the home is broken up.
3. There is some evidence that children think of one parent as the arithmetician and of the other as the reader, but this point needs further study.

